Forests at Risk

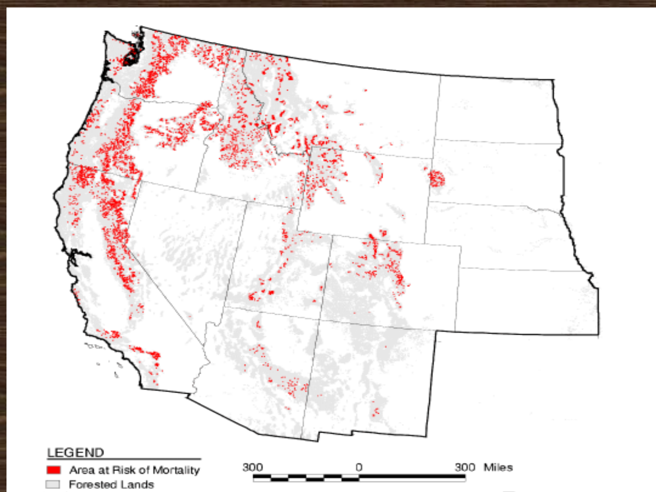
Exacerbated by poor health and drought, our western forests are at risk for catastrophic fire, severe insect outbreak or invasive species.

This places our forests, the products from them, the ecosystem, and their associated human values at risk.

Overstocked Forests Are More Susceptible to Catastrophic Outbreaks of Insects and Disease.

Due to altered stand conditions, such as dramatic increases in tree density, shifts in species composition, and improper balance of stand age distribution, many forests cannot survive bark beetle attacks.

Forested Lands at Risk of Mortality by Western Bark Beetles



Approximately 21 million acres of trees in the west are dying or could die from bark beetle attack.

These forests are also high risk for catastrophic fires, such as the devastating 2003 fires in Grand Prix and San Bernardino, CA

Crown King, AZ August 19, 2002

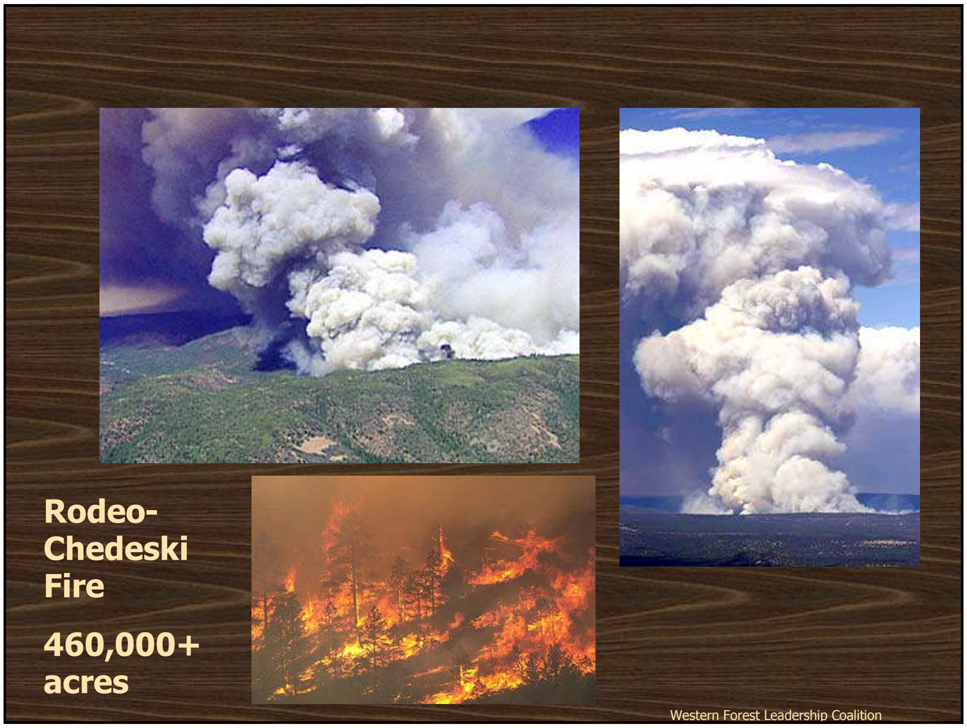
Forest Health

- **Periodic natural fires regenerate the forest ecosystem by burning out brush and small diameter trees**
  - —**Decreased competition among remaining trees**
  - —**Returns nutrients to soil**
- **Years of active fire suppression on private and public land in the west have led to unnaturally high forest fuel loads**
  - —**Small-diameter trees (<6” diameter)**
  - —**Brush**
  - —**Dead wood**

Many Forests in the Western US Are at Elevated Risk for Wildfire

- **High fuel density enables ‘catastrophic wildfires’**
  - —**Burns hotter than natural fires**
  - —**Can consume both large and small trees**
  - —**Long eco-system recovery**
  - —**Expensive to fight**
  - —**Dangerous for firefighting personnel**

- **As of 2002, the US Forest Service listed 120 million acres at “unnatural risk” for wildfire**


Rodeo-
Chedeski
Fire
460,000+
acres
Western Forest Leadership Coalition


Entire Watersheds Are Exposed by These Burns, Sometimes Leading to Flooding, Catastrophic Slope Failure, and Debris Flows.
Rattlesnake Fire, AZ, 1994
Western Forest Leadership Coalition

Rill erosion crossing a trail in the Chiricahua Mountains, AZ, Rattlesnake Fire, 1994.

Sheet erosion in a burned stand following the 1996 Dome Fire, Jemez Mountains, NM.

In some dry, relatively low productivity pine stands in the west, forest soils are thin and have probably required thousands of years to develop. After a fire, the soils may no longer support tree recruitment and growth.

The Condition of Our Forests Threatens Communities, Critical Watersheds, Wildlife Habitats, Old-growth Forests and Recreation Areas.

- People continue to build homes in and near forests.
- Forests are important sources of clean and plentiful water. Large fires can negatively impact these sources creating shortages of clean water.

Pro-actively Treating Our Forests Makes Economic Sense and Promotes Healthy Communities.

Healthy forests provide economic and social benefits to urban and rural communities: recreation, forest products, clean water, wildlife habitat, scenic quality, and jobs.

Western Forest Leadership Coalition

One Way to Reduce the Risk of Wildfire Is to Mechanically Thin Overstocked Forests

Before – High Risk Forest

Mechanical Thinning

After – Thinned Forest

- **Mechanical thinning involves the removal of small diameter trees to create a more natural forest. Simulates end-state of a natural burn.**
- **Numerous benefits to thinning include:**
  - —**Decreased risk of wildfire**
  - —**Improved resistance to insect infestation and disease**
  - —**Remaining trees grow larger and faster due to decreased competition**
- **However, thinnings have little traditional commercial value**
  - —**Thinning can not pay for itself unless combined with commercial logging**
  - —**So what do you do with all the material you remove from the forest?**

Source: Reynolds Forestry Consulting - RFC, Inc.
011,02-07-05,PYR.ppt

Univ. of Washington, Energy & Environ. Combustion Lab.

Woody Biomass

- Trees & woody plants, including limbs, tops, needles, leaves, and other woody parts.
- Grown in a forest, woodland, or rangeland.
- Products of forest management, restoration, & hazardous fuel reduction treatments.

Federal Interagency (DOE, DOI, USDA) Biomass Working Group

Thinnings Have a Number of Energy and Non-energy Uses

Uses for Thinnings

Energy Uses

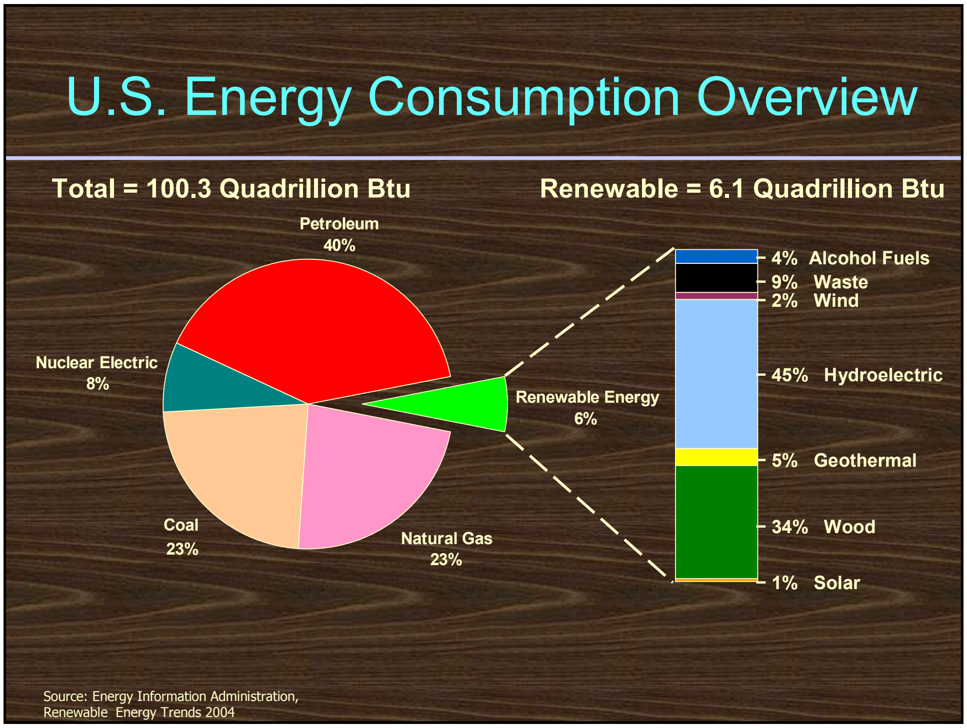
- **Wood chip heat and power cogeneration**
  - **Production of power and low-grade heat or steam from wood chips**
- **Co-fire**
  - **Substitute wood chips for portion of coal at conventional power plant**
- **Produce a bio-fuel**
  - **Ethanol & Methanol: commodity chemical, transportation fuel**
  - **Bio-oil: industrial fuel, refining feedstock**
  - **Wood Pellets: residential fuel**

Non-Energy Uses

- **Pulp and paper**
- **Forest products**
  - **Emerging small-wood industries**
  - **Long-term carbon capture opportunity**
- **Disposal**
  - **Landfill**
  - **Pile burning**

012.02-07-05.PYR.ppt

Univ. of Washington, Energy & Environ. Combustion Lab


U.S. Energy Consumption Overview
Total = 100.3 Quadrillion Btu
Renewable = 6.1 Quadrillion Btu
Petroleum 40%
Nuclear Electric 8%
Renewable Energy 6%
Coal 23%
Natural Gas 23%
4% Alcohol Fuels
9% Waste
2% Wind
45% Hydroelectric
5% Geothermal
34% Wood
1% Solar
Source: Energy Information Administration, Renewable Energy Trends 2004

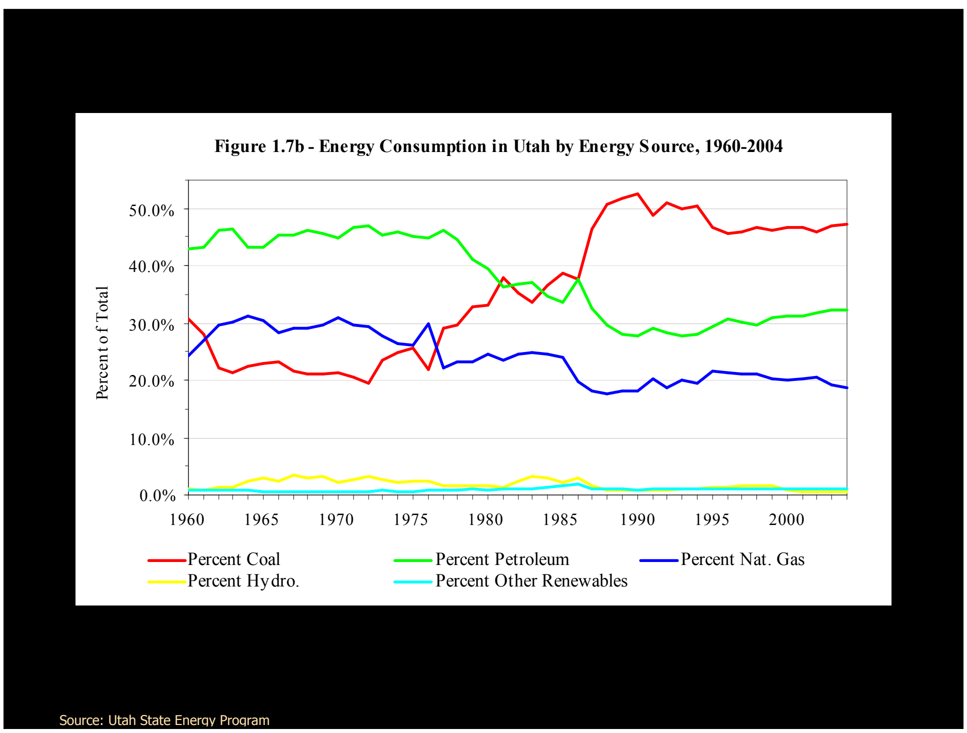


Figure 1.7b - Energy Consumption in Utah by Energy Source, 1960-2004
Percent of Total
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
1960
1965
1970
1975
1980
1985
1990
1995
2000
Percent Coal
Percent Petroleum
Percent Nat. Gas
Percent Hydro.
Percent Other Renewables
Source: Utah State Energy Program


Fuels
For
Schools
And
Beyond
www.fuelsforschools.org


MONTANA
DNRC
NORTH DAKOTA
N D
STATE
FOREST SERVICE
IDAHO DEPARTMENT OF LANDS
• USDA Forest Service Regions 1 & 4
• 5 State Foresters
• Schools
• Bitter Root RC&D
• Private sector businesses
• Others!
NEVADA
DIVISION OF FORESTRY
RANGE
FOREST
WATERSHED
PROTECTION
UTAH
Forestry, Fire and State Lands
Bitter Root
RC&D
FOREST SERVICE
U S
DEPARTMENT OF AGRICULTURE
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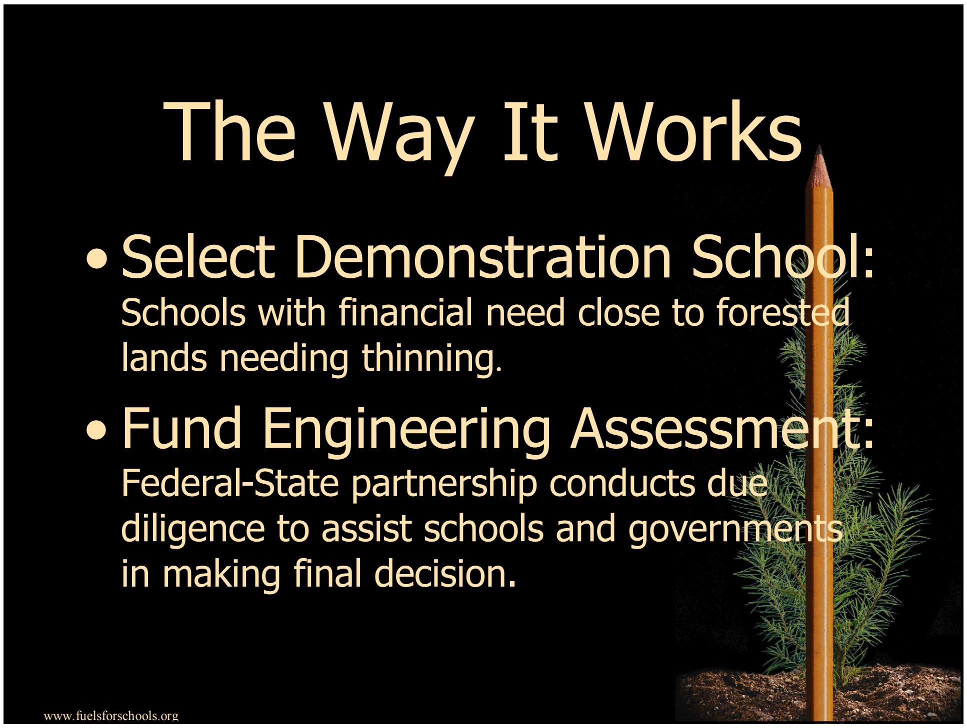
The Way It Works
• Select Demonstration School:
Schools with financial need close to forested lands needing thinning.
• Fund Engineering Assessment:
Federal-State partnership conducts due diligence to assist schools and governments in making final decision.
www.fuelsforschools.org


The Way It Works
• Forest Restoration:
Focusing on restoring healthy forests in mixed ownership.
• Thin Urban Interface:
Prioritize thinning near homes to reduce fire risks to communities.
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The Way It Works
• Chip Waste Wood:
Waste wood is removed to reduce wildfire risks in forest.
• Blow into Truck and Haul:
Local contractors are employed.
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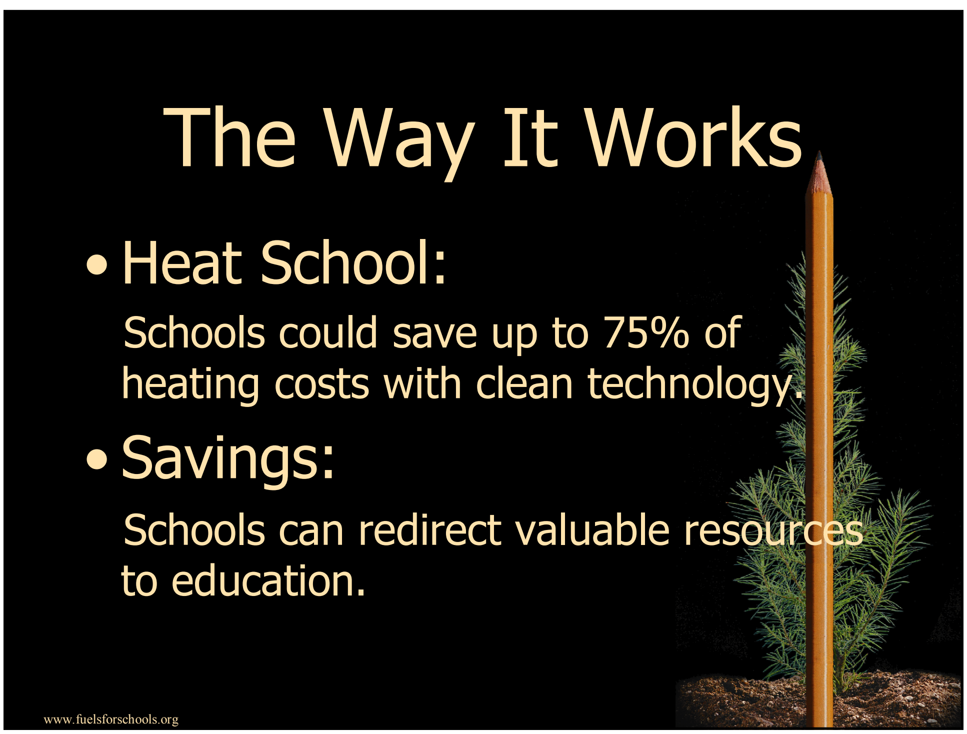
The Way It Works
• Heat School:
Schools could save up to 75% of heating costs with clean technology.
• Savings:
Schools can redirect valuable resources to education.
www.fuelsforschools.org

A Demonstration Story

- Darby, Montana
- First project of the Forest Service's Fuels for Schools initiative
- Community driven
- Grant from USDA Forest Service
- Built summer 2003
  - now operational

www.fuelsforschools.org

Darby, MT Demo

- 82,500 square feet with 550 students
- Converted their three schools from fuel oil to biomass heat energy
- Darby saved $90,000 in heating costs in 2005-06.

www.fuelsforschools.org

Darby, Montana

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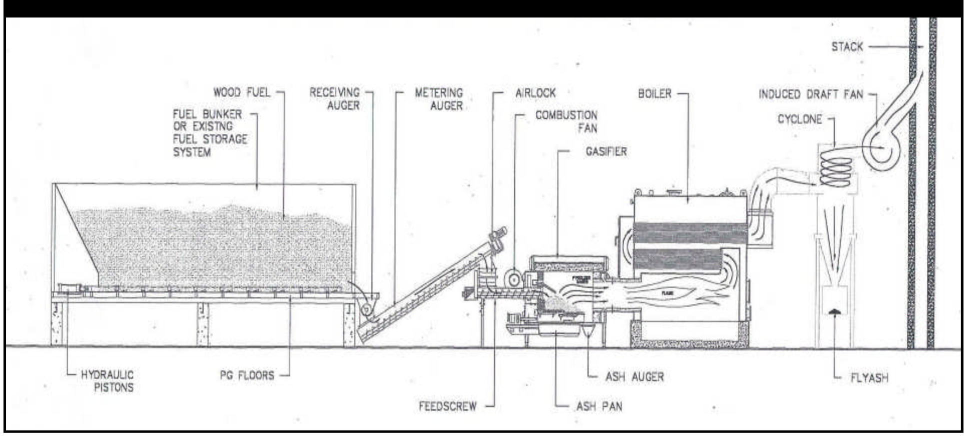
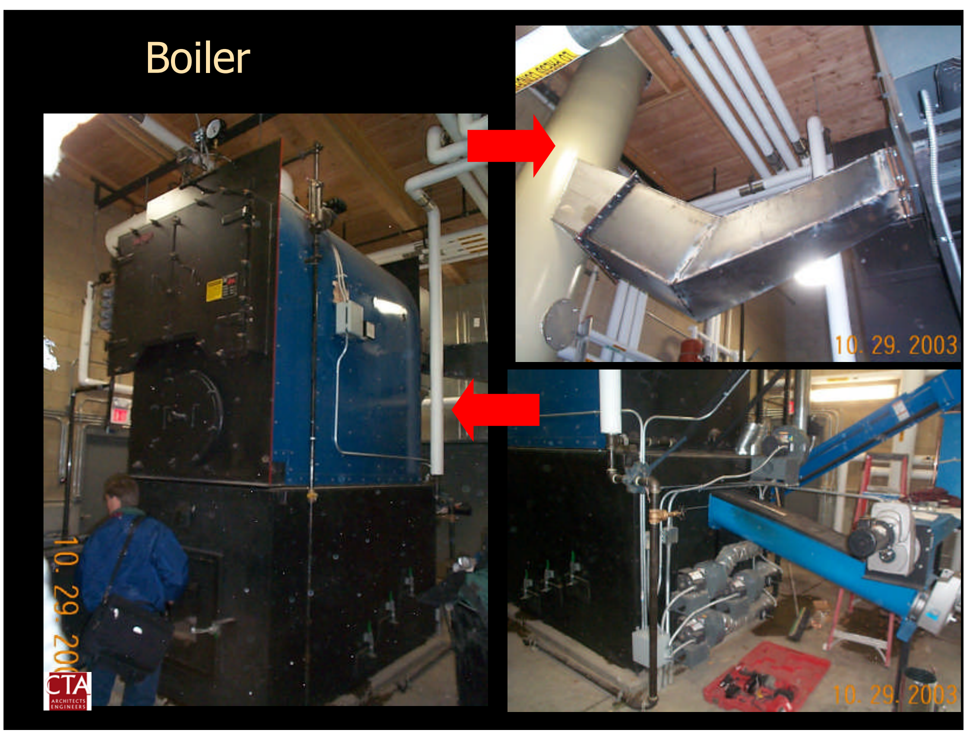
Fuels for Schools

What do systems look like?




Fuel Handling
10. 29. 2003
10. 29. 2003
10. 29. 2003
CTA


Boiler
10. 29. 2003
10. 29. 2003
CTA

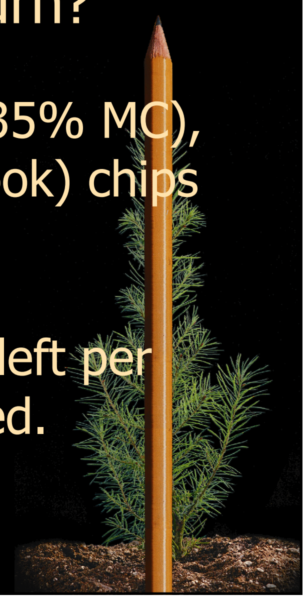
What Do They Burn?

- Darby heats 3 schools with 650-775 tons of chips/year
- Thinning operations produce about 10 tons of fuel/acre
- 65-75 treated acres heat Darby schools each year

www.fuelsforschools.org

What Do They Burn?

- Clean (no dirt), dry (< 35% MC), optimum-sized (matchbook) chips are the ideal fuel.
- Only 1.5 gallons of ash left per ton of waste wood burned.



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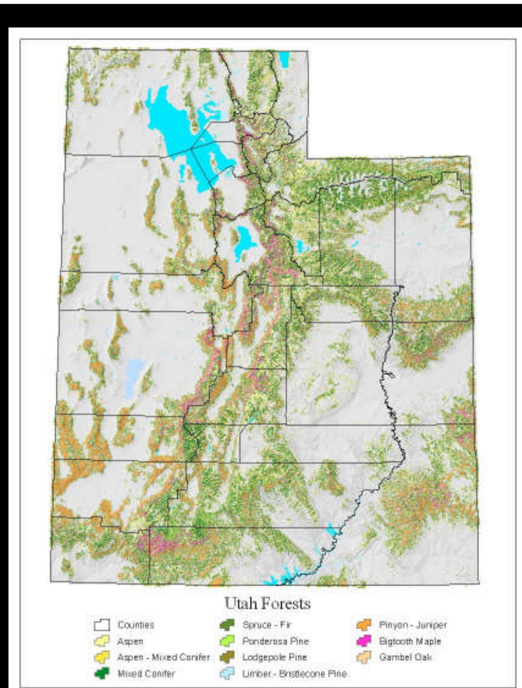
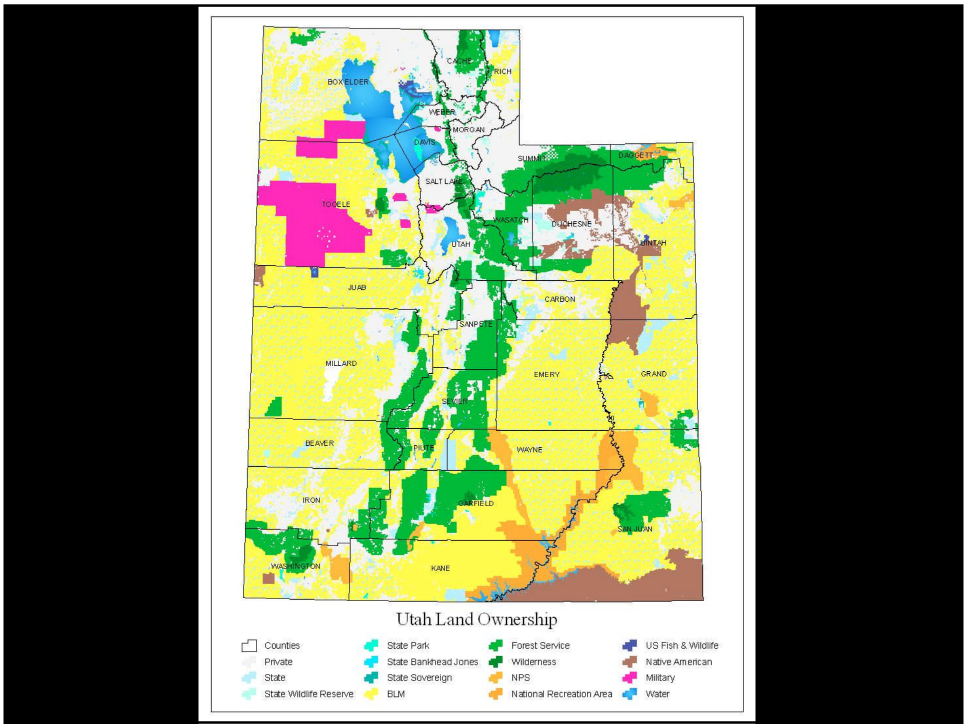
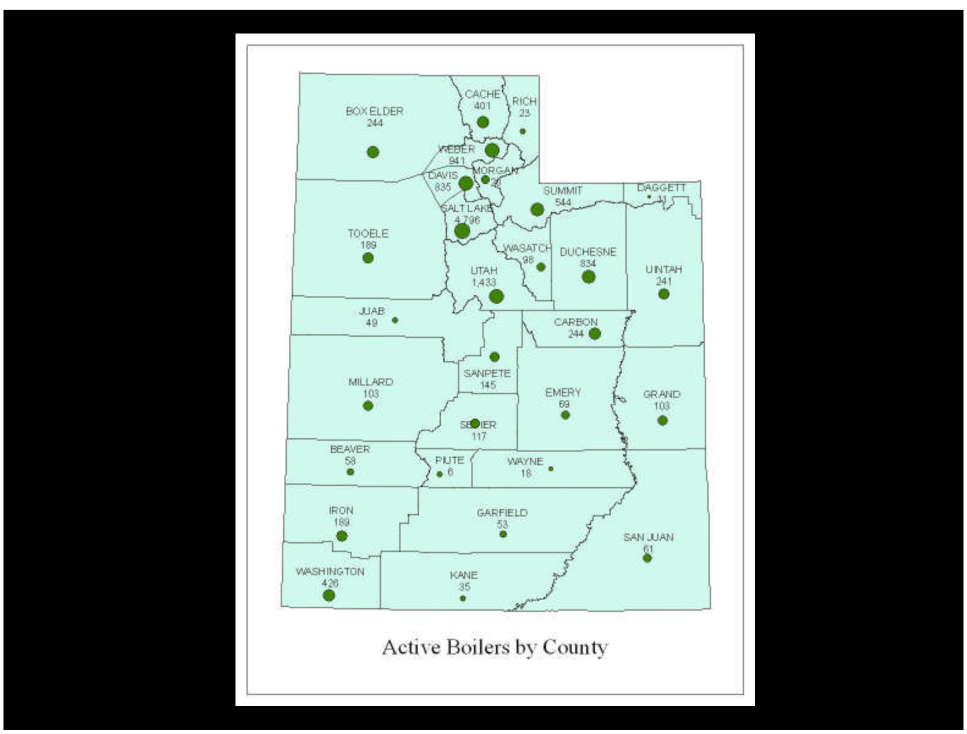
Est. Annual Cumulative Biomass Resources Available by Price in Utah (3/99, ORNL)

Delivered Price	**<$20/dt**	**<$30/dt**	**<$40/dt**	**<$50/dt**
Urban Wastes	138,765	231,275	231,275	231,275
Mill Wastes	20,000	67,000	67,000	102,000
Forest Residue	0	90,000	133,000	173,000
Ag Residues	0	0	216,546	216,546
Switchgrass	0	0	0	0
Short Rotation Woody Crops	0	0	0	0
Total	**158,765**	**388,275**	**647,821**	**722,821**





Utah Land Ownership



Active Boilers by County

Number of Boilers in Size Ranges

BOILER SIZE RANGE(BTU/hr)	NUMBER OF BOILERS
<= 500,000	5,141
500,001 – 1,000,000	2,452
1,000,001 – 10,000,000	4,284
10,000,001 – 20,000,000	217
20,000,001 – 50,000,000	140
>50,000,000	73

Number of Boilers by Fuel Type

EXISTING FUEL TYPE	NUMBER OF BOILERS
Gas	11,652 (95%)
Electric	356
Coal	118
Propane	78
Oil	68
Other	40

Number of Boilers in Age Ranges

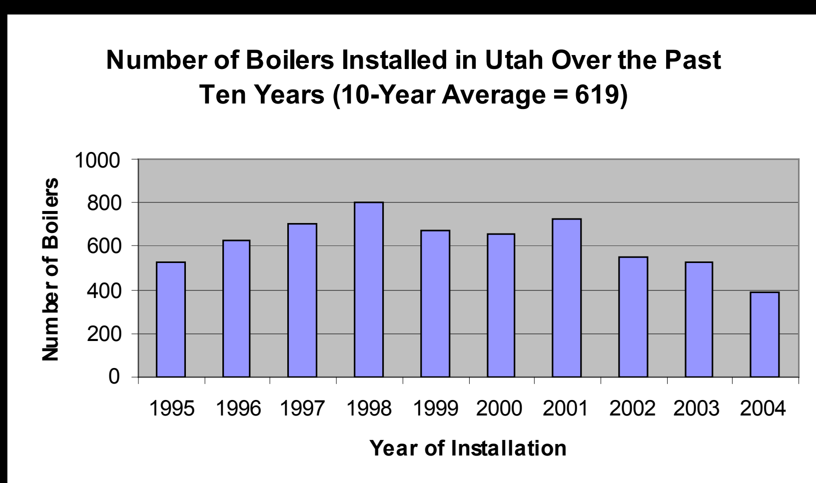
BOILER AGE RANGE	NUMBER OF BOILERS
< 10 years	5,668
10 – 19 years	3,344
20 – 29 years	1,732
30 – 39 years	724
40 – 49 years	442
50 + years	353

Number of Boilers by Facility Type

FACILITY TYPE	NUMBER OF BOILERS
Private Entity or Unknown	7,274
School	2,396
Church	945
Government	914
Health	446
Higher Education	333

Payback Scenarios All Boilers

Payback if replacing anyway	number of boilers	payback if you don't have to replace	number of boilers
< 5 years	**84**	< 5 years	**15**
5 to <10 years	**158**	5 to <10 years	**88**
10 to <15 years	**257**	10 to <15 years	**160**
15 to 20 years	**245**	15 to 20 years	**191**
> 20 years	**11,407**	> 20 years	**11,697**



New Boiler Installations

- Using the past as a predictor of the future, this information suggests that about 90 boilers will be installed each year that would be viable as biomass systems.
- If each of those 90 boilers installed each year were fueled by woody biomass, that would translate to a new wood demand of 80,289 tons of wood per year, which could be generated from thinning approximately 8,000 acres per year, based on 10 tons of excess biomass per acre.

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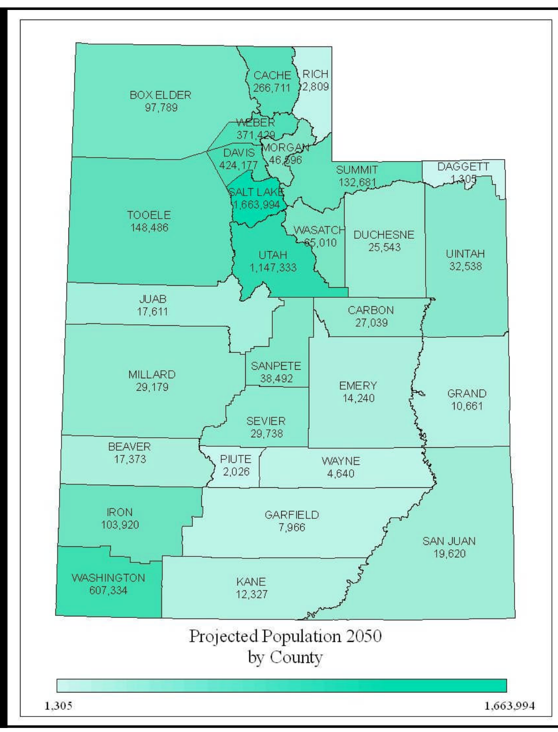
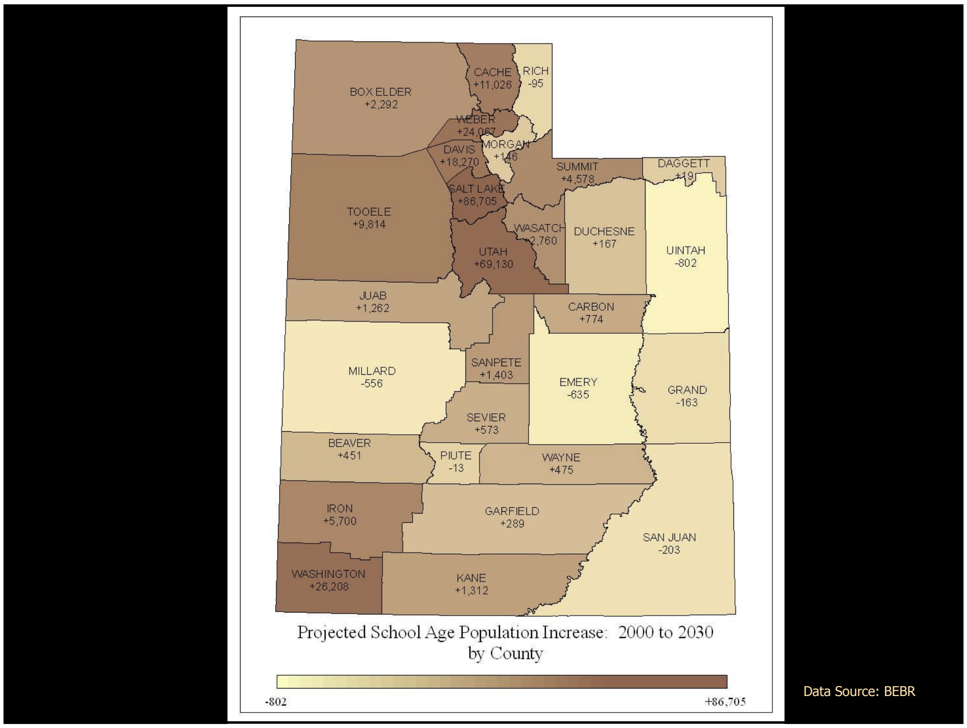


Projected Population 2050 by County

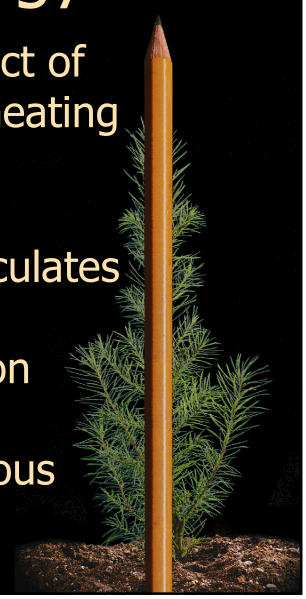
Data Source: GOPB



Clean Technology

When compared to the impact of open burning, the biomass heating systems produce

- Less than 3% of the particulates and methane
- Less than 5% of the carbon monoxide
- Less than 40% of the nitrous oxides



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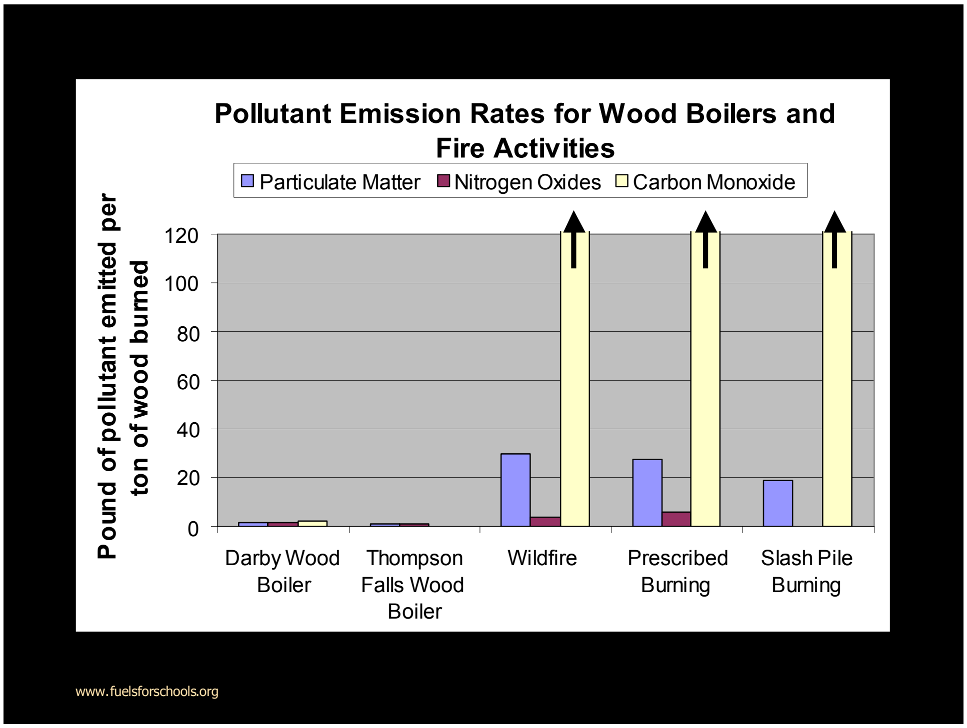
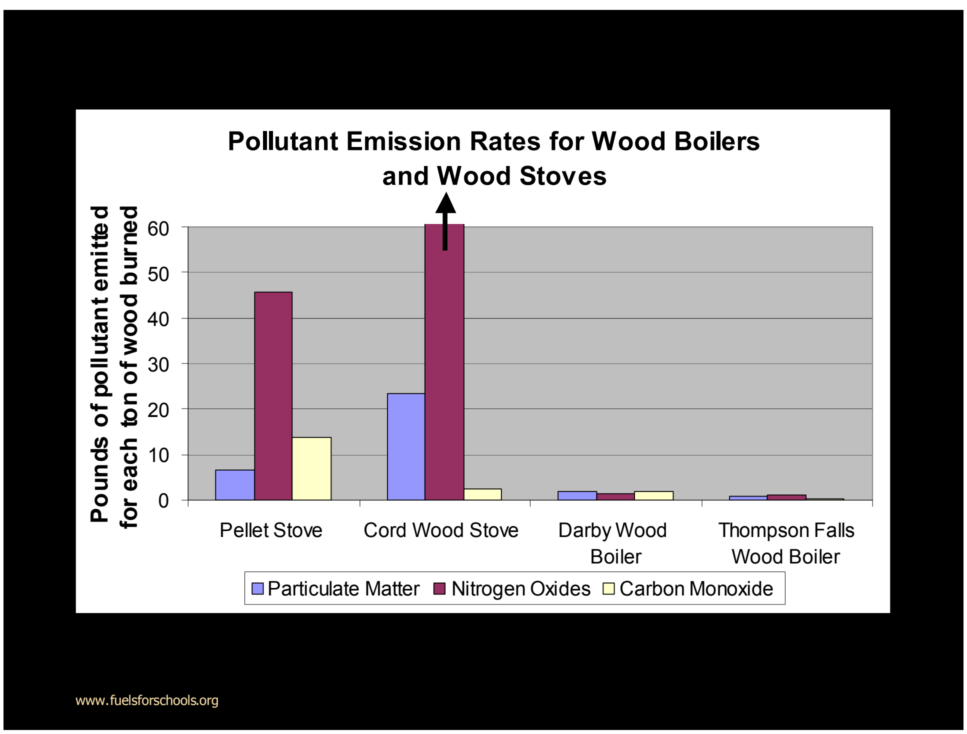
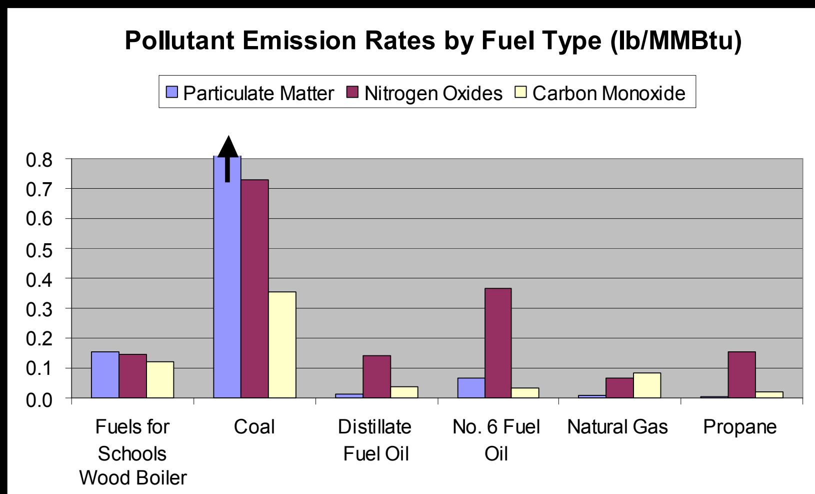

Pollutant Emission Rates for Wood Boilers and Fire Activities
Particulate Matter
Nitrogen Oxides
Carbon Monoxide
Pound of pollutant emitted per ton of wood burned
120
100
80
60
40
20
0
Darby Wood Boiler
Thompson Falls Wood Boiler
Wildfire
Prescribed Burning
Slash Pile Burning
www.fuelsforschools.org


Pollutant Emission Rates for Wood Boilers and Wood Stoves
Pounds of pollutant emitted for each ton of wood burned
60
50
40
30
20
10
0
Pellet Stove
Cord Wood Stove
Darby Wood Boiler
Thompson Falls Wood Boiler
Particulate Matter
Nitrogen Oxides
Carbon Monoxide
www.fuelsforschools.org

The wood fuel for the boiler replaces not only an alternative fossil fuel but also its alternative disposal method (e.g., open burn, landfill)



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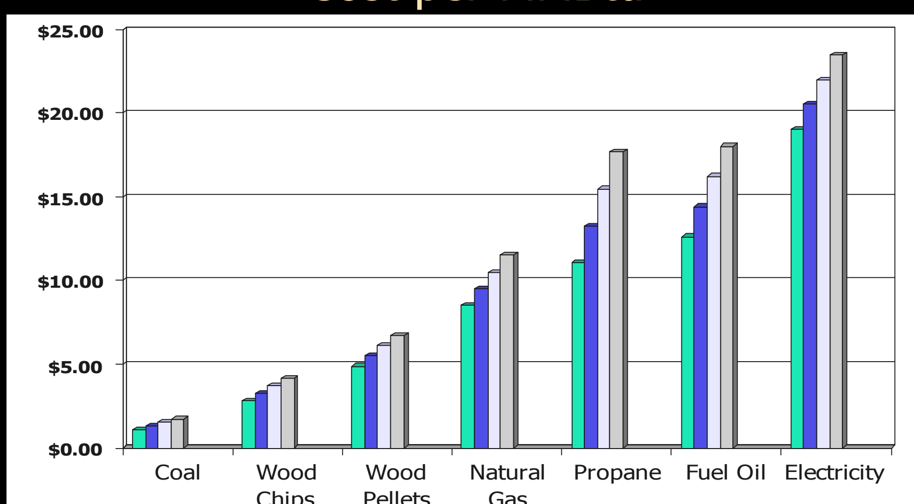
Energy Cost Comparison
Cost per MMBtu



Fuel Calculator

- http://www.fpl.fs.fed.us/tmu/documents/fuel-value-calculator.xls

DRIVERS FOR CONVERSION

School Districts and others may be motivated to convert existing heating systems to biomass - fueled heating systems for any and all of the following reasons:

- Lower, less volatile future fuel costs
- Purchase fuel locally
- Support local forest products industry
- Create market for non-merchantable timber
- Reduce fire hazard and ecosystem risks
- Renewable, sustainable fuel source
- Science and technology teaching tool

Viability of Facility Type

Low Viability

- Civic & Commercial Buildings: Intermittent Space Heat only.

Moderate Viability

- Commercial Buildings, Schools, Dormitories: Medium Demand for Space Heat, Showers & Kitchens.

High Viability

- Hospitals, Nursing Homes, Prisons, Industrial: High and Sustained Demand for Heat, Hot Water, and potentially, Power.

CTA ARCHITECTS ENGINEERS

www.fuelsforschools.org

Fuels for Schools

What should we consider?

- Current fuel types, consumption rates, costs, potential savings
- Age of existing boilers
- Compatible heat distribution systems
- Space for chip storage & delivery
- Available, reliable supply & suppliers

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Potential Funding Sources

- USDA Rural Development
- Energy Service Companies (ESCO)
- Quality Zone Academic Bonds (QZAB)
- US Congress/Dept. of Energy
- Utah Renewable Energy Incentives
- Others

Conclusion:

Fuels for Schools is

a common sense,

win-win effort!

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